

Safety Culture and Hazard Risk Perception of Australian and New Zealand Maritime Pilots¹

R.M. Darbra, J.F.E. Crawford*, C. W. Haley and R. J. Morrison

GeoQuest Research Centre, School of Earth and Environmental Sciences, University of Wollongong,
Wollongong 2500, NSW, Australia.

*also at Austow Pty Ltd. Hawthorn East, Victoria 3123, Australia.

Abstract

A survey of the safety culture and hazard risk perception has been carried out involving 77 maritime pilots around Australia and New Zealand, representing more than the 20% of the maritime pilots in each country, in proportional geographic distribution. In 82% of the cases, interviews were carried out face to face. Each interview was based on a questionnaire designed to be completed in less than one hour. Questions on four different aspects were asked, relating to each pilot's professional background, safety culture and perception of risks, navigation and pilotage hazards and their perception of the pilot's role. The main responses in addition to the most interesting comments highlighted by the pilots are presented in this paper. Finally, the paper makes recommendations which might be considered for improving operational performance and safety of navigation.

1. Introduction

Seaports have been consistently identified by respective National, State, Territory and local governments of Australia and New Zealand as key links in the logistic chains between producers and export markets and have become the subject of increasing attention with regard to their management and operational efficiency. At the same time, marked differences have become apparent² in the manner in which ports are regulated and managed and how they deliver marine services to ensure safe navigation, even when located within the same administration.

Within the complexities of the shipping and ports industries with its multiplicity of competing interests, maritime pilots, with their independent status (Douglas and Geen, 1993), have a critical role in ensuring the safe navigation of vessels in their care, by ensuring the orderly transit of pilotage districts in conformance with local regulations and rules for navigation, by protection of port facilities and commerce and

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² Various reports of investigations into maritime incidents relating to vessels under pilotage in Australia by the Australian Transport Safety Bureau, e.g. Report No.157 *Amarantos* (2000), Report No. 178 *SA Fortius*, (2002), and reports by State maritime safety agencies (e.g. Maritime Safety Victoria), and in New Zealand by corresponding reports of investigations by the Transport Accident Investigation Commission, e.g. Report No.02-201 *Jody F Millennium* (2002) and of the Maritime Safety Authority (now called Maritime New Zealand) and the recent introduction of extensive operating guidelines for effective risk management of navigation in New Zealand ports (*New Zealand Port & Harbour Marine Safety Code* (2004) MSA)

by providing a defence of the public interest in ensuring effective conservancy functions of harbour authorities and protection of the environment.

In every navigable waterway of significance throughout the world, maritime pilots conduct ships to and from the oceans to berths at the interface between land and sea during the part of each voyage which presents the greatest number of risks, yet their role and function remains largely unknown.

Some previous studies of maritime pilotage in Australia, Canada, and the United States³ have focussed on on-board issues relating to the master-pilot relationship, issues of fatigue, and restructuring of pilot service providers, but none appear to have considered the operating culture and effectiveness of the regulated environment of ports, harbours, and waterways in which ships are navigated. Commissions of Inquiry into maritime pilotage in Canada (1968)⁴ and New Zealand (1974)⁵ remain useful but are dated by significant changes in the commercial operation of shipping and ports and to the statutory and regulatory frameworks within which each operates. In addition, changes made appear to have confused and obscured previously accepted lines of responsibility in pilotage administration so that pilots and ship masters in many districts appear to operate together in a vacuum of unshared responsibility with port operators and harbour authorities.

For these reasons, it was decided to undertake this study in order to assess the current safety culture and hazard risk perception among Australian and New Zealand maritime pilots.

Safety culture can be defined as the informal set of values and norms that controls the way individuals and groups interact with each other and with people outside the organisation in order to improve the safety performance (George and Jones, 2002). In this way, the values and practices that pilots share can be very useful reducing operational, economic and environmental risks from the operation of commercial navigation in ports and harbours and other regulated waterways. . This is particularly so since human error is recognised as a major causal factor in marine accidents (Baker and McCafferty, 2005; Murdoch, 2005). Therefore, identification of areas for improvement in the safety culture and risk management provided by maritime pilots in regulated environments can contribute in an important way to a reduction in the incidence and severity of maritime accidents.

2. Objectives

Maritime pilots are a vital part of the maintaining the free flow of goods through ports and along the more hazardous coasts of Australia and New Zealand so the proposed study intended to investigate the safety culture and hazard risk perception of Australian and New Zealand Maritime Pilots by:

1. Collecting data on the safety culture of maritime pilots;
2. Evaluating the effectiveness of the current regulatory regime for maritime pilots;

³ Marine Navigation and Pilotaging National Research Council (1994).

⁴ Canada, The Bernier Commission (1968). *Report of the Royal Commission on pilotage*

⁵ New Zealand (1974) *Commission of Inquiry into Harbour Pilotage*

3. To define and evaluate pilots perceptions as to their role and functions;
4. Establishing a benchmark for future reviews;
5. To identify potential areas for improvement in risk management in ports and regulated waterways;
6. To assist improvements in the safety of navigation in pilotage waters;
7. Preparing and presenting a written report analysing the data and making the report available to administrators and maritime industry.

3. Methodology

3.1 Development of the survey

The study involved interviewing 20% of the Australian and New Zealand maritime pilots in order to gauge opinion and practices. These interviews were carried out following a structured questionnaire developed with the purpose of assessing the safety culture and hazard risk perception of the maritime pilots. The questionnaire was designed to be completed in one hour by participants together with the Chief Investigator and consisted of 80 questions. In most cases, options were provided but, at the same time, each participant was able to add any comment felt necessary.

The study was broadly based on a questionnaire developed specifically for a study of regional airlines of Australia in 1999, to assess aviation safety culture and risk (BASI-INDICATE Safety Program, 1999).

3.2 Ethics committee approval

Once the questionnaire was developed and before starting with interviews, it was submitted to the Human Research Ethics committee of the University of Wollongong to ensure that all statutory requirements were met. The Committee reviewed the ethical aspects of the research making sure that the questions were appropriate for the participants, the confidentiality of the information was ensured, and the process followed during the interviewed was suitable.

3.3 Selection of the participants and contacting pilots

The selection of participants was made on a geographical distribution basis. The aim of the study was to interview 20% of all the maritime pilots in Australia and New Zealand to ensure that no State, region, or port was under or over represented. Pilots were also selected on the basis of differing levels of experience in the industry. In this sense, it was possible to ensure that there was an equal distribution of the sample in all States of Australia and New Zealand and that there was not an excessive number of pilots drawn from any given port or region.

Once this initial distribution was completed, the Australian Marine Pilots Association (AMPA) and the New Zealand Maritime Pilots Association (NZMPA) were contacted and requested to nominate a range of respondents to reply the questionnaire according to the pre-determined distribution criteria.

Interviews were carried out personally by the Chief Investigator (82% of the cases) and only 18% of the interviews were undertaken by telephone because of distance, time, or convenience.

The assistance and cooperation of the two Pilots Associations and individual pilots in the project was excellent and enabled a large number of pilots to be interviewed (77 in total, 51 in Australia and 16 in New Zealand) in a very short period of time.

3.4 Confidentiality

All participants were informed at the outset about the confidentiality of the questionnaire. Once interviewed, a unique number was allocated to each participant and his / her identity was known only to the Chief Investigator.

The results of the questionnaire are strictly confidential and do not identify any individuals or their personal responses. All data is retained in a lockable file cabinet at the researcher's office in the School of Earth and Environmental Sciences of the University of Wollongong and no person other than the Chief Investigator has access to the original interview material (questionnaires and audio-tapes).

4. Questionnaire

4.1. Questionnaire Structure

As stated in Section 3.1, this questionnaire was based in the Bureau of Air Safety Investigation questionnaire (1996) for the regional airline industry of Australia.

The maritime pilots' questionnaire consisted of five sections:

- **Part A. Professional Background**

This section contains a set of questions intended to define the profile of the person replying the questionnaire, including general demographic descriptors (e.g., age, gender), professional background (e.g., training courses, previous experience), knowledge of organisational structure (e.g., regulatory authorities, kind of service provider) and awareness of the principal protocols relating to pilotage.

- **Part B. Safety Culture and Perceived Risk**

In this section statements are made about safety culture and perceived risk, and the respondent asked to answer each statement using the following scale:

- Strongly agree
- Agree
- Neither agree or disagree
- Disagree
- Strongly disagree

- **Part C. Navigation and Pilotage hazards**

In this Section, statements describing potential hazards are posed to identify the hazardousness of each event in terms of safety of vessels, their crew and cargoes, and

the potential risk to the environment together with the likelihood of each. The scale of evaluation of these two parameters (hazardous / likelihood) followed established practices of the BASI- INDICATE questionnaire (1996).

- **Part D. Perceptions of the pilot's role**

In this section, pilot perceptions of their task were examined. To do this, pilots were first asked to tick personally relevant options and to then to rank these in order of importance. In this section there are also three additional questions on the culture of the pilotage district in which the pilots operate using definitions given by Reason (1997).

- **Part E. Additional Comments**

Finally, Section E provided respondents with the opportunity to record any other comments relating to previous questions or to make additional general statements.

4.2. Participant evaluation

In order to evaluate the appropriateness of the questionnaire, participants were asked at the end of the study about their views of the purpose of the questions, the interview process, clarity of questions and perceived benefits the study might provide. The results of this section are presented in Section 5.5.

5. Main results of the study

This section will be structured in five sub-sections corresponding to the different parts of the interview, the first relating to professional background, the second to safety culture and perceived risk, the third to relating to hazards of navigation and pilotage, followed by the section on perceptions of the pilot's role. Finally, the participant evaluation results are presented.

5.1. Section A. Professional Background

Section A provides information about the pilots' background (e.g., age, experience, training) and the most interesting initial findings are presented below.

Position

From Figure 1, most pilots interviewed were port / harbour pilots (70%). In addition, there are 16% coastal pilots and 10% are both harbourmasters and pilots. The remaining two small groups are offshore pilots in Western Australia in the oil and gas industry and pilots who are also tug masters.

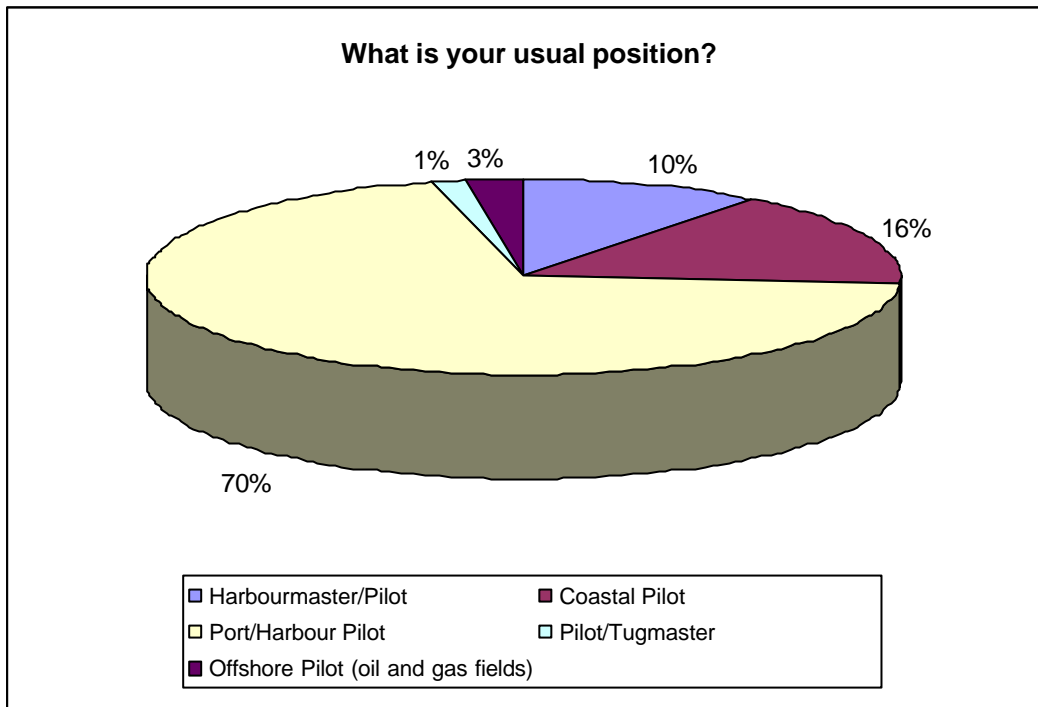


Figure 1. Occupational distribution

Age

The average age of pilots is 50 years, with the youngest age being 31 and the oldest age, 66. Distribution by age shows that most of the pilots are between 41-60 years of age. As can be seen in Figure 2, only 12% of the pilots are less than 40 years of age.

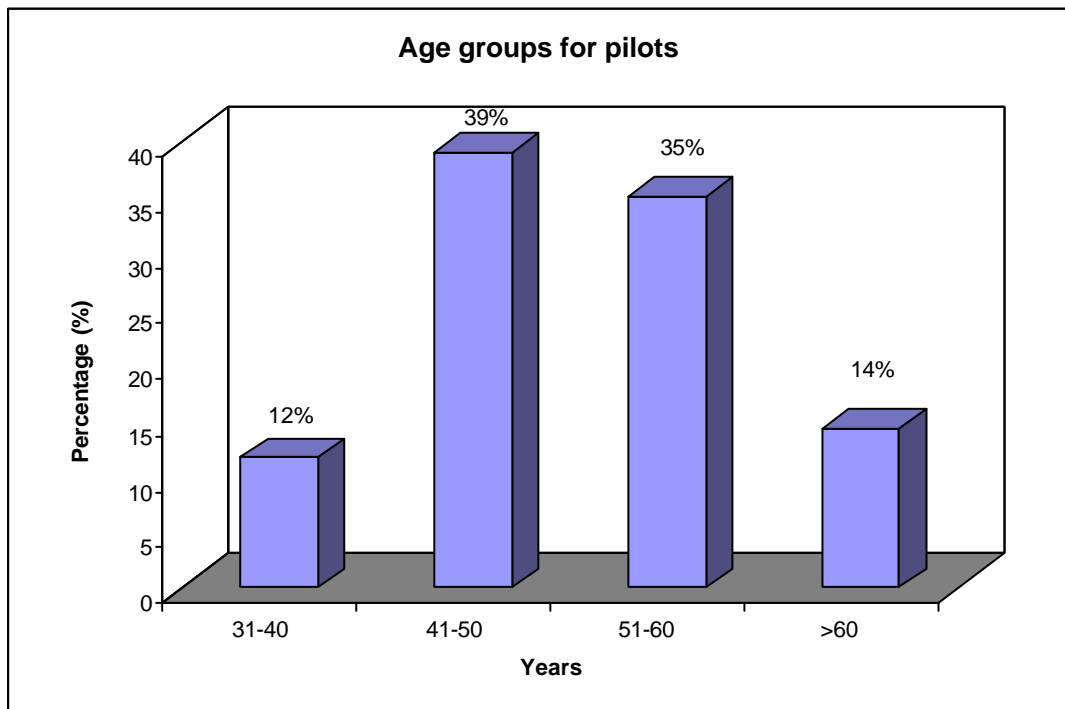


Figure 2. Groups of age for pilots

Gender

96% of the pilots interviewed were male and 4% women. Although employed in what is still a male-oriented job the three women interviewed each stated that they did not feel any kind of discrimination because of their gender. According to all of them, so long as a pilot shows confidence in what she is doing there is no problem.

Experience as a pilot

The average experience of pilots in their current port is about 10 years whereas previous pilotage experience in another port averages about 3 years. This gives a total average experience as pilot of 13 years.

Almost half of all participants have only between 0-10 years of total experience working as a pilot (see figure 3). This can be largely explained by the fact many pilots have been working for an appreciable time at sea prior to deciding to become pilots and to take up a position ashore. Some pilots stated that they had been exempt masters for some years before becoming a pilot, but such experience was not taken into account by the study.

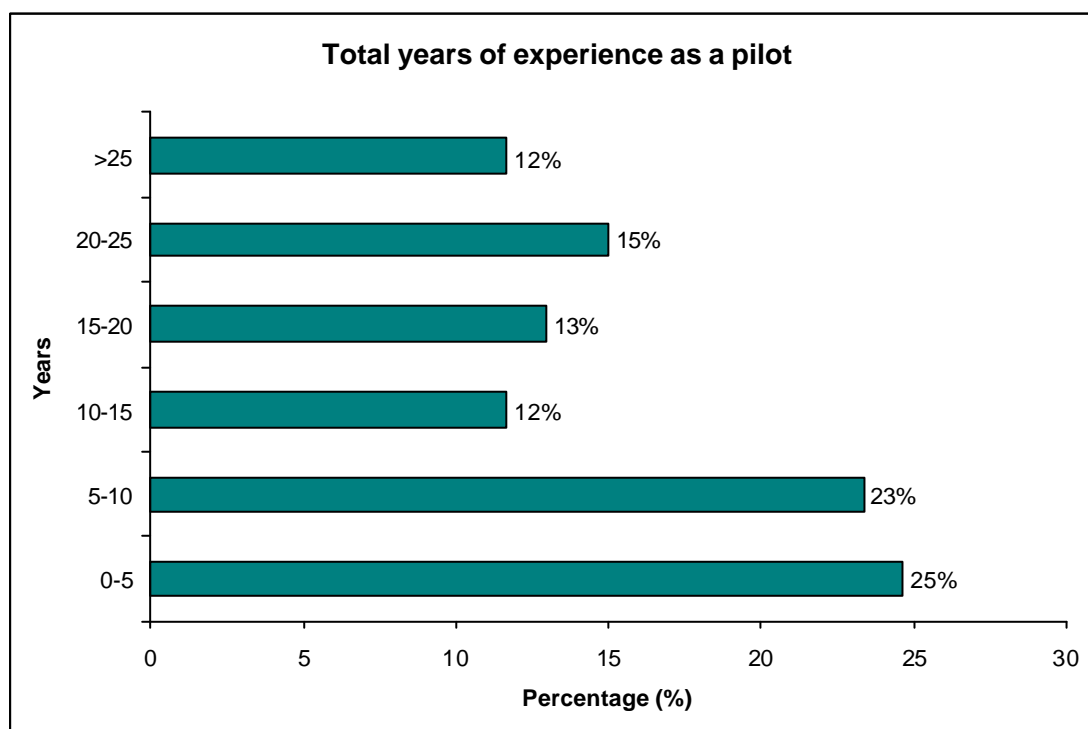


Figure 3. Distribution of the participants according total years of experience as a pilot.

Pilots Licence

There is no shared understanding about the bodies who issue pilots licences. Only in Tasmania, South Australia, Northern Territory and New Zealand, did all pilots nominate the same body. In New South Wales, there is some confusion as to who issues the pilot licence, with 43% of pilots thinking that is the port authority, and the same percentage thinking that is the State. This may be explained by the changes that

have recently occurred during the corporatisation of ports and changes to the regulatory authority. In Western Australia, a similar result occurs but to a lesser degree.

Pilot service provider (PSP)

Most (65%) of the pilot service providers (PSP) are “commercial companies” (Figure 4). Within this group, there are some different typologies such as pilots being an integral part of the port services of a commercial port, or independent pilot service provider contracted by a Port Authority, by State or by the Commonwealth to carry out the pilotage in their attached districts.

In a second position, but with a much lower percentage there are the “Port Authorities” as a type of PSP. In this case, pilots are port employees. The third position is shared by the “State” as a PSP (the pilots are State employees) and the “Commercial Company + Independent Contractor”. In the latter, the pilots are independent contractors working for a commercial company. This is the case of most of the coastal pilots. The remaining categories are present in only very low percentages.

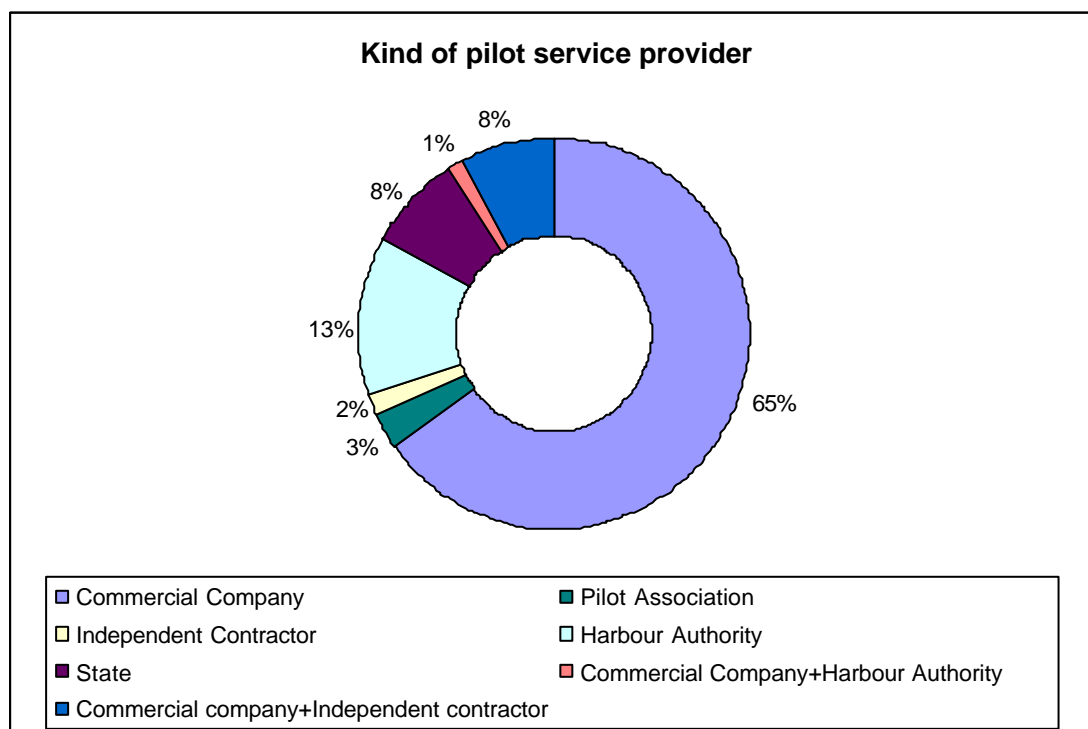


Figure 4. Kind of pilot service provider.

Regulator

The term regulator where used in this study refers to the authority directly responsible for regulating and ensuring navigation safety and pilotage in a pilotage district, usually being the harbourmaster (except for coastal pilots).

As can be seen in Table 1, identification of the regulator of pilotage and shipping safety in ports and harbour districts is unclear for many pilots. In Victoria, there are many opinions on who is the regulator of pilotage and for the safety of shipping, ranging from “the State” (43%) to “Private Company” (29%) and to “Harbour Authority” (14%). The same variation of opinion also appears to occur in Queensland, Western Australia, Northern Territory, and in New Zealand. Only Queensland Coastal Pilots agree 100% that the regulator of their pilotage districts is AMSA (which may be a reflection of the mechanisms of communication maintained by AMSA and its various studies, together with the nature of the specific regulation applicable to coastal pilots).

Table 1. Perceived pilotage district regulator according to location.

	Harbour Authority	State Authority	National Authority /Commonwealth	Private Company	State+ Corporatised port	State+ Harbour Authority	State+ AMSA + Private Company	National+ Regional Council	Nobody	I don't know
VIC	1 14.3%	3 42.9%		2 28.6%						1 14.3%
TAS		3 75.0%			1 25.0%					
QLD		10 71.4%				3 21.4%	1 7.1%			
WA	8 61.5%	3 23.1%				1 7.7%			1 7.7%	
NSW	1 14.3%	3 42.9%				3 42.9%				
SA		2 100%								
NT		1 50%				1 50%				
NZ	2 12.5%		5 31.3%					9 56.3%		
QLD coast			12 100%							

Training courses for pilots

As can be seen in Table 2, most of the pilots have undertaken Bridge Resource Management Courses (71%). This was a requirement of the pilot service provider in 32% of the cases and of the regulatory authority in 25. Most pilots also have completed Advanced Pilot Training Courses (68%). With respect to Revalidation of sea-going licences to STCW'95, 57% of the pilots have undertaken such courses, but in 12% of the cases it was not mandatory requirement of either the PSP or the regulatory authority. However, some pilots revalidate voluntarily in order to maintain currency within the maritime industry.

In the case of the AMSA required Professional Development Course for coastal pilots, 67% of them have completed this. Overall, 30% of pilots have undertaken some form of professional development courses.

Other courses were attended in lower percentages by pilots (i.e. manned model course, ship handling simulator courses, or radar observers courses).

Some pilots undertook courses that were not mandatory requirement but did so because they were strongly recommended by the pilot service provider.

Apart from the courses described, some pilots also attended other training such as the AMPA Audit Training Course, Pilotage Audit Competency Course or obtained a Commonwealth Certificate of Recognition of an existing overseas qualification.

Table 2. Training courses for pilots

	Radars Observers	BRM	Advanced Pilot Training	Revalidation to STCW'95	Pilots Professional Development	Manned Model	Shiphandling simulator
Not undertaken	85%	29%	32%	43%	70%	77%	79%
Required by Pilot Service Provider (PSP)	5%	32%	34%	26%	18%	16%	14%
Required by Regulatory Authority (RA)	9%	25%	23%	17%	6%	0%	5%
Own choice	1%	4%	7%	12%	3%	6%	2%
Required by PSP+RA	0%	10%	4%	2%	3%	1%	0%

Knowledge requirements for pilot licence

The purpose of this question is to identify what the knowledge requirements were for the pilots when first trained. From the answers to these questions, three additional categories have been added, being: “I know it because I was a ship master before”, “I know now, but not when I was trained as a pilot” and “Not applicable” (as in the case of relevance of the ATSB confidential reporting system to New Zealand pilots).

From the results attained, it is possible to say that for 34% of the pilots IMO Resolution 960⁶ (2003) was a part of the knowledge requirements for their licence. In 44% of the cases, IMO Resolution A.893⁷ (1999) was also part of the licence requirement just as the knowledge of the Port State Control requirements with respect to ships navigation equipment and operating standards. In the latter, 22% have knowledge of the Port State Control requirements because they were previously ship masters, and not because of their training as pilots. A similar result was obtained with the IMO SMCP⁸ Code. Finally, the ATSB reporting system was a part of the knowledge requirements of the pilot licence in 50% of Australian Pilots.

⁶ IMO Resolution A.960 (23) “Recommendations on training and certification and operational procedures for maritime pilots other than deep-sea pilots”.

⁷ IMO Resolution A. 893 (21) “Guidelines for Voyage Planning”

⁸ SMCP, Standard Maritime Communications Phrases

Table 3. Knowledge requirements for pilot licence.

	IMO A.960 (Training Standards)	SMCP	PORT STATE CONTROL	IMO A.893 (Voyage Planning)	ATSB Confidential Reporting System
Required	34%	36%	44%	44%	39%
Not required	39%	32%	26%	18%	19%
Not known	14%	8%	4%	4%	1%
Experience as a ship master	4%	17%	22%	17%	7%
Recent knowledge	9%	7%	4%	17%	13%
Not applicable	0%	0%	0%	0%	21%

5.2. Section B. Safety Culture and Perceived Risks

The principal results relating to Safety Culture and Perceived Risks are:

Training

Most pilots (78%) think that they receive enough training and re-training to do their work safely. However, in the case of the coastal pilots, this percentage is not so high due to a general belief that commercial competition in coastal pilotage has resulted in pilotage rates being depressed to the point where few resources are available for training.

Similarly, a lack of training was also identified by pilots in New Zealand and pilots employed elsewhere by the State. Some of these pilots believe that if they were part of an independent pilot service provider, and not operated by commercial port company or a State authority, more resources would be invested in training.

Although identifying a need for training, most pilots think that experience is nonetheless a very important part of a pilot's training and this view is often linked to the belief that experience as a ship master before becoming a pilot is also important. Such a prior background is believed by some pilots to provide appropriate skills to deal with any situation. In addition, experience in both positions (master and pilot) enables a pilot to more readily relate to a master when carrying out a pilot's job.

Communication

Eighty seven percent of pilots agree with the statement they always work cooperatively with each other to ensure timely service and navigation safety. In the case of coastal pilots, however, this level of general agreement drops to 42%. According to the coastal pilots overall, there is not much communication between them because all are very independent. Most of the times, they do not know what other pilots do, and difficulty is experienced in working cooperatively with each other.

An example of this is cited in the fact that passage plans and navigation procedures in the Great Barrier Reef Region are not standardised but are individual. Every pilot follows individual procedures and the ships find that successive passages through the reef areas are undertaken by following different and personal passage plans. Overall, a common complaint of coastal pilots was that there were no formalised safety management procedures within the Great Barrier Reef with which to provide a standard form of guidance for navigation

Commercial pressure

In 53% of all cases, pilots asserted that commercial pressure is present and results in navigation being undertaken by compulsion outside existing rules for safe navigation. In particular, 67% of coastal pilots registered agreement with the statement relating to the negative effects of commercial pressure. Most coastal pilots asserted that they felt considerable commercial pressure as a result of unfettered competition between the principal companies providing coastal pilotage services.

For the coastal pilots, commercial pressure was linked to a direct effect on safety culture and hazard reporting since they felt that they could not report as much as they would like to because they need to keep clients happy. Similarly, coastal pilots also asserted that depression of pilotage fees due to the commercial pressure did not allow PSP to have proper fatigue management systems in place, or to carry out effective checks of pilot launches, or to ensure an on-going supply of suitable trainees for pilots (since the wage now offered is so low).

Port pilots in New South Wales (71%) and Western Australia (62%) also strongly agreed that commercial pressure results in pilots working outside established rules. A particular cause of commercial pressure was attributed to shipping agents seeking to reduce the number of tugs used to manoeuvre ships.

For the offshore pilots, commercial pressure was stated to be very low, as they are happy with the companies they work for “because they understand the situation”.

Finally, pilots in Victoria felt commercial pressure in only 30% of cases. In general, the remaining pilots identified an advantage in working for an independent and unique pilot service provider which resulted in reduced commercial pressure.

Investigations of incidents

The opinions of pilots with respect to investigations into navigation incidents are quite diverse. In 52% of cases pilots agreed that investigations are carried out by a well-understood selection and analysis process although they also believed that more pilots should be involved in investigation processes. Some pilots suggested that there should be a national pool of pilots that could be called upon when an investigation was to be carried out, since such experienced professionals would be better able to understand what happened and to be able to assess events on the basis of experience.

Pilots from South Australia, New South Wales, and New Zealand disagreed more with the quality of the processes followed during incident investigations than pilots in other jurisdictions.

In general, pilots think that the blaming culture that still exists needs to be transformed into an open reporting and positive safety culture. Nevertheless, most maritime pilots are satisfied with the investigative processes/systems followed by the ATSB (Australian Transport Safety Bureau) in Australia and TAIC (Transport Accident Investigation Commission) in New Zealand.

Fatigue management

Most pilots (80%) independently ensure that fatigue is not a matter for concern when they do their jobs. Different systems on how to manage fatigue were shown to the Chief Researcher in different places. However, it is important to highlight the fact that commercial pressure sometimes does not allow fatigue to be managed as effectively as pilots would like, and a lack of pilots in some remote areas, such as the Northern Territory, makes fatigue management more difficult than in other areas.

Most of the participants (65%) agreed that the harbourmaster or regulator does not check fatigue management systems due to lack of time and because of changes in the harbourmaster's role in recent years. However, 83% of coastal pilots asserted that their regulator is very aware of the system to control fatigue.

Support provided by VTS

Although 75% of the pilots asserted that support provided by VTS, Signal Stations, or Port Control Services is useful, 65% agreed that VTS systems should be managed by a pilot. According to them, VTS operators are not well trained to do all the aspects of their job because they do not have maritime experience and this leads to mistakes being made.

The role of National and States Authorities

Half of all pilots believe that regulatory authorities of the States, Commonwealth and New Zealand take a positive interest in the conduct of pilotage services in their districts, whereas the remaining half believe that such interest is only evident when things go wrong or when there is an accident. This latter opinion is most evident among the pilots of New Zealand, the Northern Territory and Tasmania.

Reporting system

Most pilots (88%) state that incident reporting structures are very clear which suggests the existence of robust and standardised reporting systems. Coastal pilots, however, are more reluctant to report because, according to them, they cannot report as much as they like due to the commercial pressure under which they are working. The fear of losing clients does not allow them to report all the incidents they see. In addition, the fact of their initiating a report may have negative consequences for their relationship with their PSP and also with investigating bodies (although the latter assessment was not quantified). However, not only coastal pilots feel discouraged

from reporting, some port pilots asserted that if a pilot was to report “too much”, the PSP would consider such reporting as “trouble-making”.

Another subject related to reporting is the efficiency with which deficiencies or faults are rectified. In 65% of the cases, pilots state that the responsible authorities take a lot of time to rectify reported problems.

5.3. Section C. Navigation and Pilotage Hazards

This section presents the results of the most hazardous and likely events according to the pilot perceptions. In order to do so, two rankings of the degree of hazard and probability of occurrence have been developed.

Hazardousness

The term hazard can be interpreted as any event, activity or phenomenon that can cause harm in terms of human injury or ill health, damage to property, damage to the environment or a combination of all these (Casal et al, 1996). In this study the hazardousness of the event has been defined as the potential to affect safety of ships crew, cargo and environment.

From the responses to the questionnaire, it has been possible to establish a ranking of the most hazardous events in pilotage (Table 4). The most hazardous event in pilotage is likely to occur when engine starting, steering or anchoring equipment fails during manoeuvring or navigating. In 85% of cases, pilots consider these events to be very hazardous or extremely hazardous. In addition, this happens quite often (see Table 5) making the pilot’s task much more difficult and of increased risk.

The second event of the scale of hazardousness relates to poor boarding arrangements (e.g. incorrectly rigged pilot ladders, poor location, poor onboard access). Many pilots complained about this aspect of the pilotage task and considered it to be one of the most hazardous parts of their job. Moreover, it happens very often (Table 5).

The failure of the tug lines as well as the failure of the master of the ship or personnel to follow pilot directions is also considered very hazardous, although the case of tugs lines only relates to port pilots and not coastal pilots. Concerning the master’s rejection to follow the directions of the pilot (4th statement), even if hazardous, its likelihood is low since most pilots believed there is always room for an agreement being reached between the master and the pilot.

In 6th position in the ranking there is the “readiness and efficiency of navigation / propulsion equipment misrepresented to pilot by master”. According to pilots interviewed, ship masters sometimes do not want to reveal information which might cause pilots to report to authorities matters that may create problems for the ship. If the status and efficiency of the ship and its equipment are misrepresented, the pilot may unexpectedly have to deal with a dangerous situation.

Table 4. Top ten hazardous events in pilotage.

TOP TEN HAZARDOUS EVENTS IN PILOTAGE	Position
Starting / steering / anchoring equipment failures when manoeuvring or navigating	1
Poor boarding arrangements (e.g. incorrectly rigged pilot ladder, poor location, poor onboard access)	2
Failure of tug lines	3
Failure of ships master and / or personnel to correctly follow pilots directions (e.g. refusal, rejection, intervention by master)	4
Navigating and ship handling in marginal operating conditions when subject to commercial pressure	5
Readiness and efficiency of navigation / propulsion equipment misrepresented to pilot by master	6
Pilots navigate vessels outside published guidelines or limits (draft, higher swell, lower tide, etc.)	7
Incorrect operation of ships equipment (missed orders, incorrect interpretations, etc.)	8
Failure of regulator to enforce efficient regulations for safe navigation (e.g., for small craft, adequate UKC, passing rules)	9
Incorrect ship details provided to pilot / port (draft, efficiency of machinery, etc.) prior to pilotage	10

The fact that the pilots navigate vessels outside published guidelines or in marginal operating conditions has been considered among the 10 most hazardous events associated with marine pilotage. Sometimes pilots have to work even if the tide is low, the swell is too high or there are strong winds at or above port limits. This can be attributed to commercial pressure in some cases, but also occurs in other places owing to routine weather and geomorphologic conditions being poor where pilots become inured to the operating conditions in order to “get the job done”.

The 8th and 10th statements in the ranking could be in a higher position but due to timely intervention by pilots they are not always so hazardous. In the case of incorrect operation of the ships equipment, the pilot usually picks up very quickly the mistake made and can solve the problem. Where incorrect ship details are provided to a pilot prior to undertaking a pilotage act, the experience and skills of a pilot are particularly important, especially where a pilot checks every detail provided when boarding, in order to minimise the risk of experiencing problems during the pilotage. Both events happen quite often (see Table 5), so it is considered important that pilots are proactive in checking and defining problems before they become significant.

During the study, it was noted in most of the events statements used for questions, the older pilots were, the less hazardous they considered each situation. This can undoubtedly be explained on the basis of age having provided more experience to draw on.

Probability of occurrence

The probability or frequency of occurrence of an event is an important parameter in risk assessment (Vilchez et al, 2002). According to the perceptions of the pilots interviewed, a ranking of the most likely events in pilotage has been developed (Table 5). The lack of a conducive working environment for pilotage occurs frequently since 52% of pilots consider that this happens every month or more often and 31% every three months. Here, some pilots noted that creating an effective working environment on the bridge of a ship is not only the duty of the shipmaster and the ships bridge team alone but also a duty of the pilot. In fact, since it is the pilot who enters in a different environment belonging to others, so he / she must respect this. However, some pilots also asserted that some shipmasters are consciously difficult and challenging during the pilotage task. Other masters simply disappear. In general, pilots recognised the diversity of cultures and the consequential need for appropriate behaviour in engendering effective bridge resource management. In any case, even if this event is most likely, it is not considered really hazardous (ranked in 15th position out of 20).

The second most likely event is the failure of ships to prepare and present informative and mandatory passage plans. In this, most pilots asserted that ships practically never prepare passage plans because they know that the pilot is the person who is going to do the job, so they do not bother to engage in what they appear to feel is duplication. Some pilots also think that the passage plans produced by ships are of minimal value. Moreover, this event has been considered the least hazardous of the 20 events assessed.

Pilots reported that poor workplace design is another frequently experienced feature of pilotage. In general, pilots get used to it and learn to manage the situation. For this reason, they do not consider it really hazardous. However, pilots frequently noted a lack of visibility as being a common and most important issue.

In fifth position, pilots nominated failure of the regulator to enforce effective regulations for safe navigation. However, in almost all cases, pilots were referring to the interference to the navigation of larger vessels caused by small craft. According to those interviewed, in 27% of the cases, such events occur every month or more often. At the same time, this kind of event is also considered hazardous (9th position in the ranking) because many sizable ships do not follow regulations and unreasonably occupy the centre of navigation channels when encountering other (piloted) vessels.

Table 5. Top ten likely events in pilotage.

TOP TEN LIKELY EVENTS IN PILOTAGE	Position
Failure of ships to provide working environment conducive to pilotage (BRM, attentiveness, etc.)	1
Failure of ships to prepare and present informative mandatory passage plans	2
Poor workplace design (e.g., wheelhouse instrumentation, location, accessibility, visibility, clarity, ergonomic layout, etc.)	3
Incorrect operation of ships equipment (missed orders, incorrect interpretations, etc.)	4
Failure of regulator to enforce efficient regulations for safe navigation (e.g., for small craft, adequate UKC, passing rules)	5
Poor boarding arrangements (e.g., incorrectly rigged pilot ladder, poor location, poor onboard access)	6
Inadequate charts, navigation equipment and / or operating language in use on ships	7
Engine starting / steering / anchoring equipment failures when manoeuvring or navigating	8
Incorrect ship details provided to pilot / port (draft, efficiency of machinery, etc.) prior to pilotage	9
Inadequate supervision and/or training of onshore service providers (VTS / Signal Station, lines, tugs)	10

Concerning the seventh ranking event, most pilots assert that the main problem is the operating language in use on ships rather than the charts (which are not considered a significant problem since pilots have their own. Some ships crews have problems with the English language. Sometimes mistakes may occur due to misunderstanding of the pilot orders. Most of the pilots agreed that they can handle this situation and even if this happens quite often it is not considered very hazardous (13th position out of 20).

The inadequate supervision of onshore service providers has also been considered hazardous by the pilots because they are an important aid to their work. This question evinced many complaints about VTS operators and about their training. One of the interesting results from this question was the fact that when all service providers (in the same port) were integrated, the pilots were able to ensure that they were checked, whereas in those situations where the tugs or lines services are part of a different

organisations, pilots were frequently unable to verify that the required services were available and on time.

“Never experienced” events

After having heard from pilots of the events considered the most hazardous and most likely according to pilot perceptions, it was interesting to highlight those that have never been experienced by many pilots. In 52% of cases, pilots state that they have never failed to produce passage plans prior to piloting vessels. Only in cases of insufficient warning did pilots fail to produce formalised passage plans.

In 34% of cases, the pilots never experienced regulations or rules for navigation that were inadequate, open to interpretation or unclear. Those pilots also consider that existing rules are clear enough and in 31% of cases they consider that updating of navigation information is carried out by authorities in a timely manner. This is not a surprising result, given the relatively well-developed operating systems of some ports.

About 33% of the pilots interviewed stated that if the weather conditions are not safe they would not do the job and that they would not navigate vessels outside published guidelines, even if there was commercial pressure.

Also about 30% of the pilots have never experienced an absence of knowledgeable support to pilotage from the responsible managers or a lack of real-time information for navigation (e.g., tide height, swell height, wind speed) that again, undoubtedly reflects experience of a well-run and well-equipped harbour or port.

5.4. Section D. Perception of the pilot’s role

In this Section the perception of the pilot’s task was examined, with interesting results.

To the question “as a maritime pilot, do you regard your job as being the nature of”, the first answer chosen was “Navigation Safety” (Table 6), followed by “Environmental Protection”. Both options were ticked by pilots in practically all cases (99% and 97%) and were never rated in importance below number 4 (with choice N. 1 being the most important) in the ranking. “Conservancy Management”, “Commercial Task” and “Public Interest” were all in a very similar position (about third place) followed at some distance by “Non Commercial Task”, ticked only in 25% of cases. A particularly interesting aspect of this response was an indication of how marine pilots feel strongly about their role as guardians of navigation safety and protectors of the environment, yet at the same time they are able to pragmatically recognise their role as being that a “Commercial Task”.

Table 6. Nature of the pilot's job.

Nature of:	Mean	Number	Ticked	Minimum	Maximum
Navigation Safety	1.3	76	99%	1	4
Environmental Protection	2.2	75	97%	1	4
Conservancy Management	2.9	56	73%	1	6
Commercial Task	3.1	66	86%	1	6
Public Interest	3.3	55	71%	1	6
Non Commercial Task	4.5	19	25%	1	6

Regarding how pilots see themselves when conducting navigation, the first choice in the ranking is ‘Leader of the Bridge Team’ selected in 69% of cases (Table 7). After that, and with a similar value, ‘Advisor to the Master’ (chosen by 61%) and ‘In Command of the Vessel’ (chosen by 12%) occupy 2nd and 3rd positions.

In the case of ‘Advisor to the Master’, the word ‘Only’ as it originally appeared in the questionnaire (‘Advisor to the Master Only’) was taken out by practically all pilots who ticked it. The ‘Representative of the PSP’, ‘Port Authority’ and ‘Port Operator’ all occupy middle positions. In some cases, these three bodies were the same. The lowest rankings by far have been ‘Port or Waterways security’ and ‘Additional Navigation Officer’.

Table 7. Role of the pilot when conducting navigation.

I see myself as:	Mean	Number	Ticked	Minimum	Maximum
Leader of the Bridge Team	1.6	53	69%	1	4
Advisor to the Master	1.9	47	61%	1	8
In Command of the Vessel	1.9	9	12%	1	6
Substitute for the Master	2.2	5	6%	1	3
Representative Pilot Service Provider	2.6	47	61%	1	7
Representative Port Authority	2.8	28	36%	1	5
Representative Port Operator	2.8	22	29%	2	5
Port or Waterways Security	3.2	20	26%	1	6
Additional Navigating Officer	3.3	25	32%	1	9

It is important to highlight that in 20% of cases, other options were provided by pilots who did not find an appropriate option in the questionnaire. When this occurred, most of these new definitions were ranked first, including:

- “in charge of the navigation of the vessel”
- “control of the navigation of the vessel”
- “advisor to the master and ship handling”
- “manager of high risk operation”
- “participant in the bridge team”
- “additional member of the bridge team”
- “additional officer”
- “person responsible of the safe conduct of the ship”
- “advisor to the crew”
- “in conduct of navigation of the vessel”
- “advisor to the bridge team”

- “member of the bridge team”
- “coordinator of the pilotage operation”

Concerning the question “who most influences navigation safety rules and limits in your pilotage area?”, the first option and also the most ticked option was “Pilots Collectively” followed very closely by the “Harbourmaster”. The latter was only ticked in 64% of the cases. After that came “Port Authority”, “Regulator” and “Pilotage Operator” with similar values. “Masters of Ships” and “Ships Agents” were placed last in the ranking, but this does not reflect the opinion of pilots about masters, but only indicates that the master is not seen to have much influence in formulating rules for the safety of navigation in pilotage waters.

Table 8. Influence on the navigation safety rules and limits in the pilotage area.

Influence on navigation rules:	Mean	Number	Ticked	Minimum	Maximum
Pilots Collectively	1.7	60	78%	1	4
Harbourmaster	1.9	49	64%	1	4
Port Authority	2.2	29	38%	1	4
Regulator	2.2	28	36%	1	6
Pilotage Operator	2.2	26	34%	1	5
Pilots Individually	2.4	32	42%	1	5
Commercial Port	2.4	14	18%	1	5
Ship Charterers	2.5	2	3%	2	3
Port Users Committee	3.1	14	18%	1	5
Harbour Engineers / Hydrographers	3.5	18	23%	1	6
Masters of Ships	3.8	13	17%	2	7
Ships Agents	4.7	3	4%	1	7

5.5. Participant evaluation

At the end of each interview a sheet with 5 questions about the design of the questionnaire was passed to participants. The aim of this was to assess the level of satisfaction of the participants with the questionnaire and also to obtain some feedback in order to improve the future design of questionnaires.

All of the participants replied to this last section and the results are presented below:

Question 1. Did you find the questions appropriate for the stated aim of the study?

Not appropriate 1 2 3 4 5 Most appropriate

As it can be observed in Figure 5, most of the participants considered that the questions were “very appropriate” or “most appropriate” (85%). Of the remainder, 14% replied “appropriate” and only 1% replied “slightly appropriate”. None thought found the questions “inappropriate”.

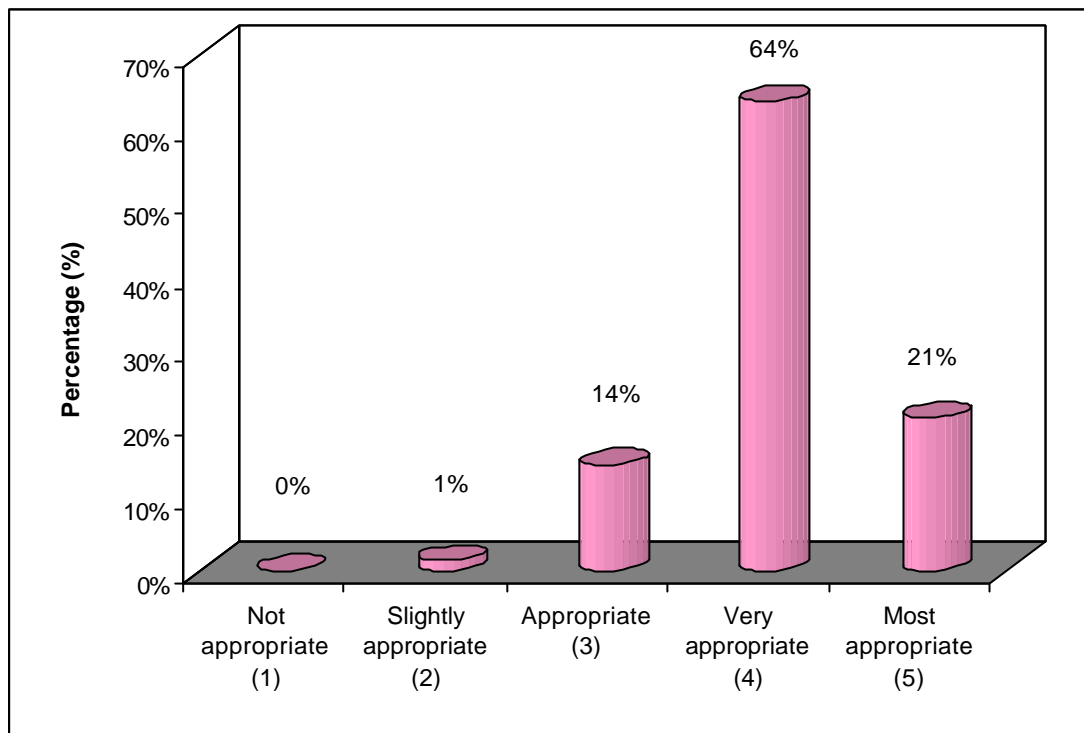


Figure 5. Appropriateness of the questions.

Referring the appropriateness of the process followed during the interview, 96% of the pilots considered it “very appropriate” or “most appropriate”. The rest replied that the processes were “appropriate”.

With respect to the clarity of the questions, 30% replied “very clear”, 49% “clear”, 18% “quite clear” and only 3% replied “slightly clear”. None replied that the questions were “not clear”. One of the problems encountered by some pilots was the fact that in section B affirmative statements are combined with negative ones. This created some problems between the participants because they could not give a straightforward reply and had to think a little bit about the meaning of the statement.

In the fourth question, concerning the emphasis of each one of the sections, most of them agreed that the questions were satisfactory, but as it can be seen in Table 9, 19% thought that more emphasis could have been placed on “Professional Background”, 22% thought more emphasis on “Safety Culture”, 12% more emphasis on “Navigation Hazards” and 31% believed that more emphasis could have been placed on “Perceptions of the Pilots Role”.

Table 9. Emphasis of the questions.

	More	Less	Satisfactory
Professional Background	19%	3%	78%
Safety Culture	22%	1%	77%
Navigation Hazards	12%	3%	84%
Perceptions Pilot's Role	31%	1%	68%

Finally, concerning the benefit of the study for maritime pilots, 42% believed the study “most beneficial”, 34% “very beneficial”, and 21% “beneficial”. Of the remainder, 1% believed the Study to be “slightly beneficial” and 3% of “little benefit” (Figure 6).

Two main opinions exist among pilots about the benefit of the study. One is that any kind of study carried out to assess the pilots’ performance is positive, and the other is that the benefit of the results of this study depends on the people who will listen to them. If the regulator and / or government takes some action with regard to the final recommendations of the study, this will be beneficial, but some pilots asserted that most “bosses” do not listen to the results of these studies, so at the end it does not matter.

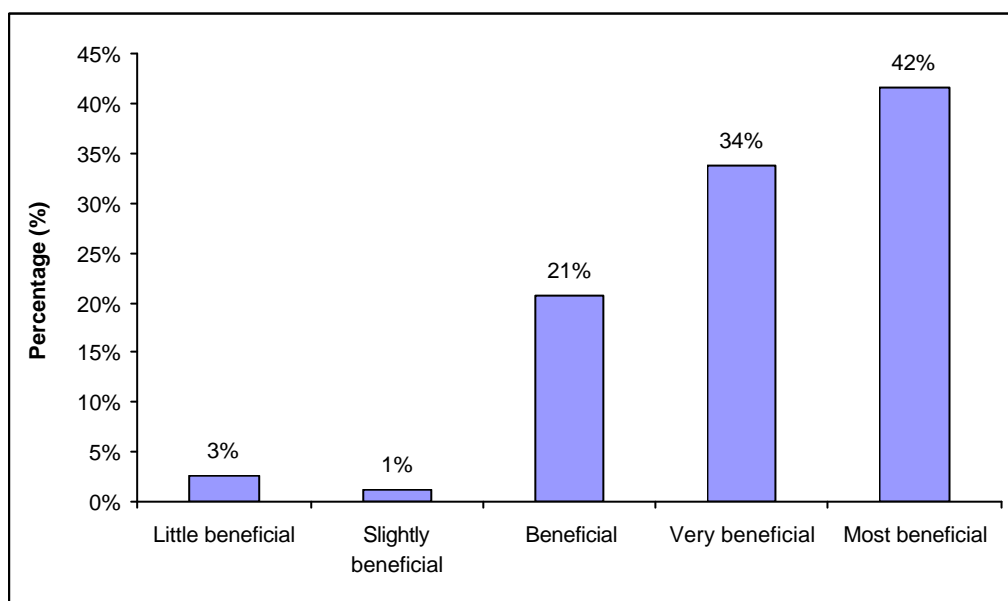


Figure 6. Benefit of the study.

6. Conclusions

As stated earlier, the aim of this study was to assess the safety culture and risk in marine pilotage perceived by maritime pilots, but at the same time to give some recommendations for the improvement. They are presented below:

- Due to all the changes in recent years in the pilotage structure, the identification of the regulator has become a difficult point. There should be a better understanding of and by the body that regulates pilots and each pilotage district. Regulators and pilots should take action in order to solve this problem.
- Commercial pressure which affects pilots, especially coastal pilots has a direct effect on the safety culture, risk, hazard reporting, fatigue management and training. It is therefore necessary to reduce commercial pressure on pilots because of the potential negative effects on the conduct of the task.

- Confidential reporting should be ensured. Pilots should be able to report incidents and deficiencies without encountering external / internal pressures or the fear of discrimination or retribution or of being automatically blamed in investigations.
- The blaming culture needs to be translated into a safety culture and reporting. If there is no feedback about the incidents, it is not possible to build any safety management system.
- Standard passage plans should be developed for the coastal pilots of Queensland and better communication should be engendered between coastal pilots.
- Adequate resources for training should be guaranteed in pilot services since the professional performance of pilotage is essential to the roles of safe navigation, protection of the environment, and guarantors of the safe and timely conduct of commerce across the thresholds of ports.
- More emphasis on the bridge resource management must be given to avoid the high frequency of poor working environments on bridges of ships. The concept of teams and unified purpose should be promoted by regulators and authorities and be developed among ship masters, bridge teams, and pilots.
- More information should be provided to small craft and regulators should enforce existing regulations in order to create and maintain a safe operational environment for all users of commercial waterways.

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